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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2019/2020

### **EME1016 – APPLIED STATICS** (ME)

17 OCTOBER 2019  
9:00 a.m – 11:00 a.m  
(2 Hours)

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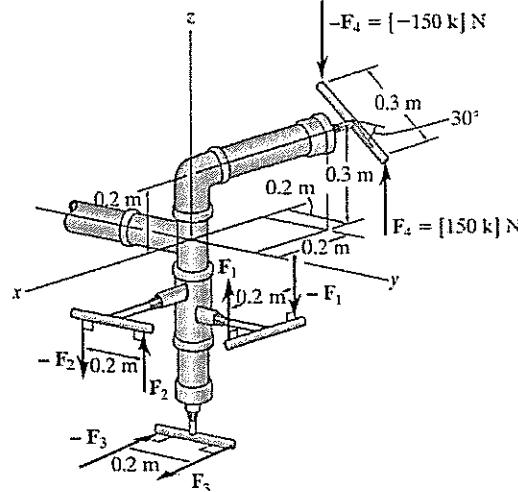
#### INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 6 pages with 4 Questions only.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

**Question 1:**

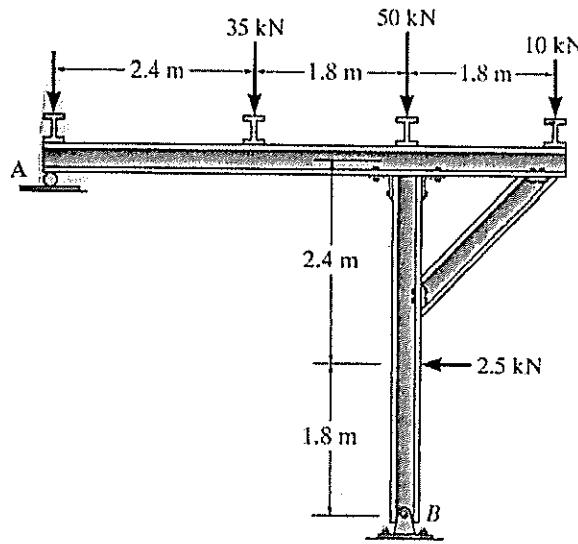
(a) Four couples are acting on the pipe column. Given  $F_1 = 150 \text{ N}$ ,  $F_2 = 170 \text{ N}$  and  $F_3 = 90 \text{ N}$ .

(i) Find the Cartesian vector form for each of the couple moment. [10 marks]  
 (ii) Determine the magnitude of the resultant couple moment. [2 marks]  
 (iii) Determine the coordinate direction angles of the resultant couple moment. [3 marks]

**Figure 1**

(b) **Figure 2** shows a frame that being supported by 2 supports at Point A and Point B.

(i) Draw the FBD of the frame. [4 marks]  
 (ii) Determine the force acting at support A and B. [6 marks]

**Figure 2****Continued.....**

### Question 2:

Figure 3 shows a truss which is supported by four external loads. The truss is supported by a hinge at A and roller at E. Given  $P_1 = 20 \text{ kN}$  and  $P_2 = 16 \text{ kN}$ .

(a) Draw the FBD of the truss. [4 marks]  
(b) Determine if zero force member exists in the truss. Specify? [2 marks]  
(c) Find the reaction of the support at A and G. [10 marks]  
(d) Find the internal force within the members EB, CD and CB. State whether it is compressive or tensile. [9 marks]

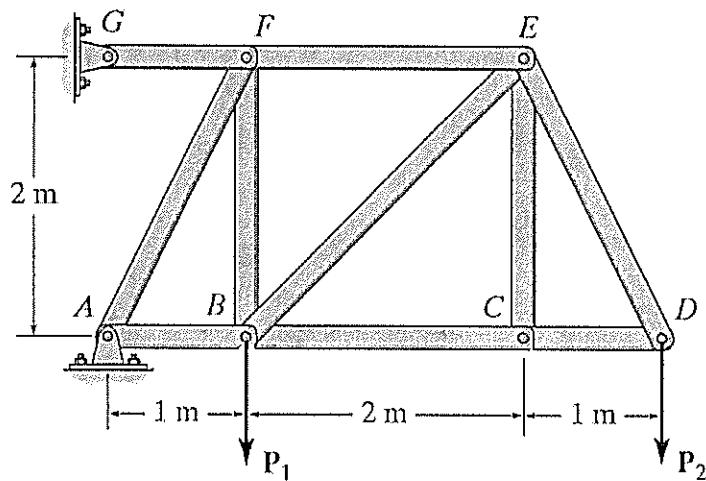


Figure 3

**Continued.....**

**Question 3:**

(a) Draw the free body diagram and determine the reactions at pin *A* and roller *B* on the beam as shown in Figure 4. [8 marks]

(b) Draw the shear force and bending moment diagrams for the supported beam as shown in Figure 4. [17 marks]

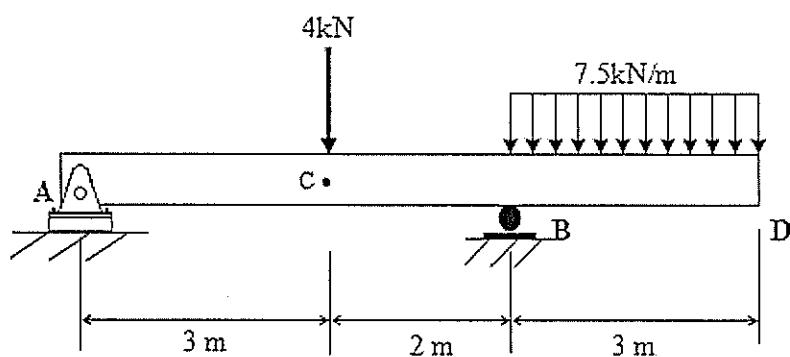


Figure 4

Continued.....

## Question 4:

(a) For the beam's cross sectional areas as shown in **Figure 5**.

- (i) Determine the location  $\bar{x}$  of the centroid,  $C$  of the beam's cross-sectional areas. [5 marks]
- (ii) Determine the moment of inertia for the beam's cross-sectional area about the  $y'$  axis. [5 marks]

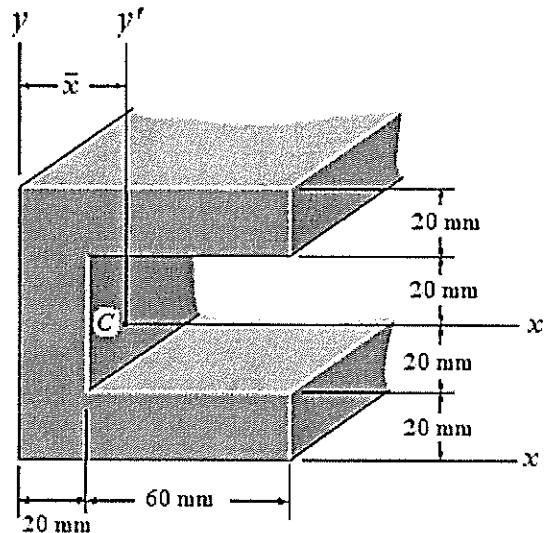


Figure 5

(b) The weight of 16 N block  $A$  is attached to link  $AC$  and rests on the weight of 24 N block  $B$  as shown in **Figure 6**. Knowing that the coefficient of static friction ( $\mu_s$ ) is 0.20 between all surfaces of contact and neglecting the mass of the link  $AC$ .

- (i) Draw the free body diagram (FBD) of the block  $A$  and block  $B$ . [5 marks]
- (ii) Determine the value of  $\theta$  in degree for which motion of block  $B$  is impending. [10 marks]

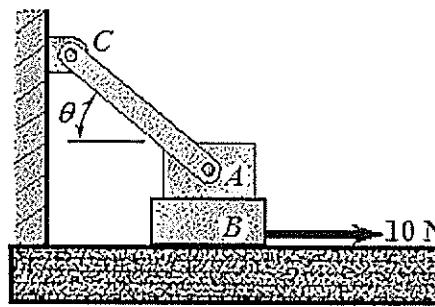
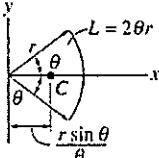
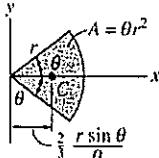
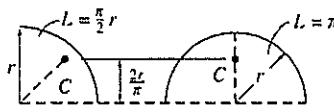
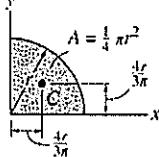
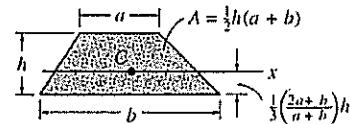
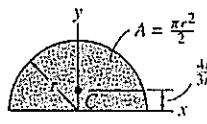
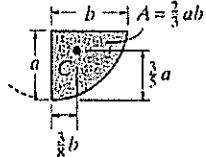
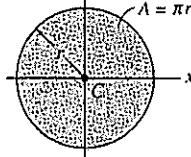
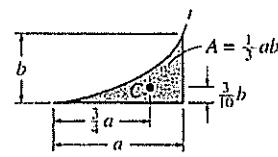
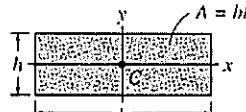
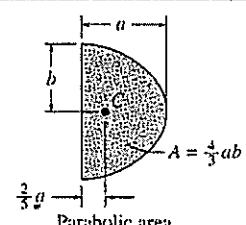
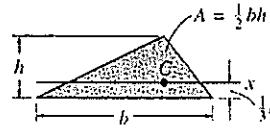


Figure 6

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## Appendix: Geometric properties of line and area elements

Centroid Location	Centroid Location	Area Moment of Inertia
 <p>Circular arc segment</p>	 <p>Circular sector area</p>	$I_x = \frac{1}{3} r^4 (\theta - \frac{1}{2} \sin 2\theta)$ $I_y = \frac{1}{3} r^4 (\theta + \frac{1}{2} \sin 2\theta)$
 <p>Quarter and semicircle arcs</p>	 <p>Quarter circle area</p>	$I_x = \frac{1}{16} \pi r^4$ $I_y = \frac{1}{16} \pi r^4$
 <p>Trapezoidal area</p>	 <p>Semicircular area</p>	$I_x = \frac{1}{8} \pi r^4$ $I_y = \frac{1}{8} \pi r^4$
 <p>Semiparabolic area</p>	 <p>Circular area</p>	$I_x = \frac{1}{4} \pi r^4$ $I_y = \frac{1}{4} \pi r^4$
 <p>Exparabolic area</p>	 <p>Rectangular area</p>	$I_x = \frac{1}{12} bh^3$ $I_y = \frac{1}{12} hb^3$
 <p>Parabolic area</p>	 <p>Triangular area</p>	$I_x = \frac{1}{36} bh^3$

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